Introduction:

The CubeSat Project is an international collaboration of over 40 universities, high schools, and private firms developing pico satellites containing amateur radio and scientific payloads. A CubeSat is a 10 cm cube, that is a cube approximately 4 inches on a side with a mass of 1 kg. Those mandatory limits are not to be exceeded. The principal interest of the schools participating is to achieve an educational objective. All developers benefit from sharing information between all participants.

CubeSat Comments - Difficulty of Compliance:

Data for predicting orbital behavior for satellites of these small dimensions is severely limited because there is little or no published data pertinent to predicting the orbital behavior of satellites of such small dimensions. The best reference available is James R. Wertz and Wiley J. Larsen, editors, Space Mission Analysis and Design, 3rd Edition. Using this reference for orbital lifetime predictions for a CubeSat in LEO at 650 km and extrapolating data from tables therein results in orbital lifetimes of questionable value. Picosats are quite different. The science needs to do better! There may be an empirical approach towards a solution within University and AMSAT mitigation goals. Here is an approach:

As an Effort to Comply:

Students in the CubeSat Project at California Polytechnic State University plan to derive orbital behavior, using empirical data from exiting CubeSats CUTE-1 and XI-IV presently in the proposed orbit. Keplerian elements for these satellites are available from NASA with a continuous history of measured data since launch in July 2003. This reliable resource should allow first order approximation with accuracy's an order of magnitude better than presently calculable and based on observed data of similarly sized CubeSats.

Continuing Effort to Find Actual Orbital Life of CubeSats:

The CubeSat community through the several Universities involved, plan to conduct active de-orbit experiments on future launches. These will not involve large thrust motors due to obvious size limitations but rather elegant hardware not in existence today. Trailing drag increasing the area to mass ratio and ballistic coefficient are a possibility. The "Cal Poly hands on" approach will be used to enhance lifetime predictions noting especially even shorter orbit life due to deployable, inflatable devices and antenna size as a significant addition to total CubeSat area.

Dr. Jordi Puig-Suari
CubeSat faculty head
Department Chair, Aerospace Department
California Polytechnic University
San Luis Obispo, California

Clifford Buttschardt
Retired Faculty
CubeSat mentor, Amateur radio K7RR
California Polytechnic University
San Luis Obispo, California

Edward English
Faculty Emeritus, Cuesta College
CubeSat mentor, Amateur radio W6WYQ
California Polytechnic University
San Luis Obispo, California